to interfere selectively with the function of the autonomic neurons and ganglia. Knowing the fine details of synthesis has allowed us to pinpoint rate-limiting steps in the formation of catecholamines and to design competitive inhibitors of critical enzymes (tyrosine hydroxylase and dopamine beta oxidase) that can lead to true decreases in the rate of catecholamine synthesis. These drugs (for example, alpha methyltyrosine) have been extraordinarily useful in selected instances of pathologic overproduction of catecholamines. Very likely, with the help of organic chemists and molecular pharmacologists, we will be able to design safer drugs, with great tissue specificity, that can be used to alter the modulating role of catecholamines on such diverse functions as glucose tolerance, hunger and obesity, sleep and inflammation.

The scientist may offer additional discoveries in the future. What will be the pragmatic importance of understanding more of the chemistry of the granules of the postganglionic nerve ending? Will there be clinical uses of medical sympathectomy, for example, with 6-hydroxy dopamine (not covered in the symposium)? If the past is any indication of the future, the clinicians will put such information to good use. Maybe they will also ask the scientist if stimulation of the gut by catecholamines will raise its cyclic adenosine 3′, 5′-monophosphate (AMP) content, as does cholera enterotoxin that causes the severest of diarrheas.

The example of applying basic facts concerning catecholamines to medical settings is not at all unique, nor are the vignettes of mutual dependence described in this editorial or in the symposium at all inclusive. An intimate interdependence between scientist and clinician utilizes fully Koch's principles that apply philosophical logic to science.

Objectivity about gains in medicine and science indicates what the public should have reinforced: that no single group deserves overwhelming accolades for the health benefits the people receive. Rather, it is the joint effort which merits praise. If success (to scientist, physician, patient and patron) is to be continued and consistent, the bonds of this interdependence must be defined and applied, and the results of this union must be demonstrable.

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Health Science and "Humanization"

THE SPECIAL ARTICLE by Professor Clark Kerr, formerly president of the University of California and now chairman of the Carnegie Committee on Higher Education, which appears elsewhere in this issue calls attention to what may be a most important role of medical and health science in the future of higher education in this nation. Dr. Kerr suggests that social changes which have already begun will profoundly influence higher education for many years to come. He notes that there is likely to be greater social emphasis on "humanization" with greater interest in a better access to a high quality of life for more people and with more attention being paid to the individual needs of people. In this connection he predicts "golden decades" ahead for the health sciences in terms of opportunities to do more and more for the American people. He stresses that the "health sciences are not only more central to the welfare of our people as a whole, but also more central to the conduct of higher education as our best contact with the people, our best service to the people." He goes further and says, "It may come to be that the greatest help that higher education will receive in this 'time of troubles' will be from the success of the health professions."

These are words to ponder for physicians and medical associations, as well as for medical educators. They suggest that the health professions will in the future, as is even now the case, be concerned with more than the prevention and cure of disease, although this will always remain a primary responsibility. In addition to this he is of the opinion that the health professions are destined to become inextricably involved in what may be called the "humanization" of human society and with it higher education. A concern with human individuality and the quality of human life is actually nothing new for physicians, who have always been more concerned with more aspects of human individuality than any other profession. And they have traditionally

striven to help their patients reach and enjoy the highest quality of life that their personal situation would allow. So perhaps what may need to be done now is to extend the reach of medicine and health science so that what has been traditionally done for the patient can begin to be done for society as a whole.

It happens that there is a special opportunity in California to do something tangible right now to strengthen the base of medical and health science in our institutions of higher education. Five of California's eight medical schools are in the University of California system. On the coming November ballot there will be a proposition for a bond issue to provide funds for essential construction and essential improvements in the facilities of these schools of medicine and health science. The CMA Council strongly supports this bond issue and urges the physicians of California to do everything they can to get it passed. By doing this they can take an essential step to create a firmer base of medical and health science in higher education in this state, a step absolutely necessary for the production of health personnel who are needed now, and in preparation for whatever "golden decades" there may be ahead for the health sciences. It will be tragic if this great state is not prepared both to fulfill its immediate needs and to realize its longer range opportunities.

Drug Interactions

Drug interactions are the pharmacologic sequelae attending the simultaneous use of two or more drugs, which may result in enhanced or diminished drug effect. Drug interactions may be direct, dependent on the chemical or physical properties of the drugs involved, or indirect, the reaction to a second drug being mediated by pharmacologic changes in the patients elicited by the first drug given.

The frequency of drug interactions in clinical practice is only now becoming apparent. In the past few years, a host of publications dealing with this topic have appeared in the clinical literature, more than a hundred commonly used drugs being involved. Additionally, epidemiologic studies have shown that the incidence of adverse reactions when patients take fewer than five drugs is approximately five percent. When patients are given 20 or more drugs, the incidence of adverse reaction rises to 45 percent. The expotential rise of adverse reactions during multiple drug therapy strongly suggests the possibility of drug interactions.

Elsewhere in this issue of CALIFORNIA MEDICINE, Jack N. Turner has assembled "Some Potential Interactions Between Prescribed Drugs and Over-the-Counter Products." We are a drug-taking society at least in part because of the success of the advertising agencies' ability to convince us to take medication for trivial or self-limited conditions. Commercial blandishments and the ready availability of non-prescription drugs in food stores and even saloons mislead patients into believing that these substances are harmless. The study by Ronald B. Stewart and Leighton E. Cluff cited below disclosed that 98.3 percent of patients who had taken prescription medications in the month preceding a clinic visit had also administered non-prescription medications to themselves during that same period. Turner asserts that practically all over-the-counter drugs should be available only on prescription. This position has its merits but is not currently practical, as we would not have enough physicians to write the prescriptions and it seems unlikely that the public would accept legislation that would drastically reduce their access to non-prescription drugs. As physicians become more familiar with the problem of drug interactions, they will likely devote more time to patient education about the hazards of multiple drug therapy, including exposure to non-prescription items.

The article by Turner brings into focus another problem involving drug interactions. It is very difficult to keep them all in mind. The number of drugs involved in interactions and their complex interplay with disease states will eventually require computer methods to store information about known interactions and to prospectively predict potential drug reactions based on information regarding chemical and pharmacologic properties of the agencies given for diseases. Such a warning system would not limit a physician's prescribing prerogatives, as not all potential drug interactions occur in all patients and the physician's therapeutic goals may be worth some risk. Nor would a computer system reduce the physician's obligation to monitor patients receiving multiple drug therapy with great care to detect